



2

Technical Support

Financial Analysis



Straight to Your Bottom Line

The savings from your energy bills go straight to improving your profits. The National Restaurant Association reports that the average restaurant typically spends approximately two percent of its revenue on energy. Approximately four percent of revenue becomes profit. So if a business owner reduces energy costs by 25 percent (from 2 percent to 1.5 percent), total bottom-line profit increases from 4 percent to 4.5 percent of revenue. This increase in profit is the same as a 12.5 percent increase in sales!

Use the worksheet on this page to calculate the sales increases required to match the value of your savings opportunities.

Indirect Financial Benefits

In addition, the total return on your project includes these financial components that are quite real, if indirect:

Enhanced employee productivity. Due to enhanced comfort and improved lighting conditions, the productivity of your staff may increase.

Operations and maintenance savings. Many energy-efficiency technologies significantly reduce your operations and maintenance requirements, saving money and staff time.

Increased customer comfort. Building upgrades will improve your facility's appearance, make your products look their best, and help your customers enjoy their visit. This can increase sales.

Increased asset value. Efficient businesses have higher market values than wasteful ones. Studies on home sales show an \$11 increase in sales price for every \$1 decrease in annual energy costs. Studies on businesses show a 3-percent increase in stock value after energy upgrades are announced. The market recognizes the business benefits of energy-efficient operation.

Protection from energy inflation. By performing energy-saving upgrades, you are replacing the monthly expense of your energy bills with the fixed cost

Savings from your energy bills may directly improve your profits.

What Is Energy Worth to You?

1. You've got a great energy savings idea. How much will it save per year? (A) \$_____
2. Enter your pretax profit as a percentage of sales: (B) _____ percent
3. Divide A by B: (C) _____

Line (C) shows your equivalent annual increase in sales once your savings have paid for the cost of the measure. The table below will help you quickly look up the equivalent sales amount.

Equivalent Annual Increase in Sales

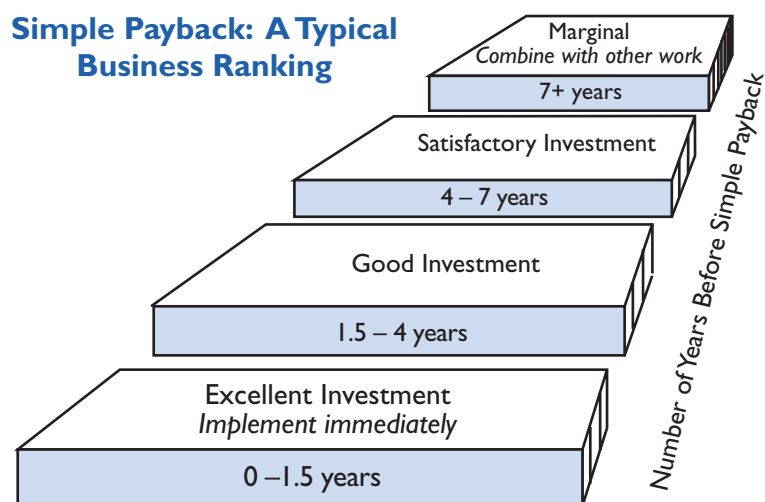
Annual Cost Savings for the Measure	Profit as a Percentage of Sales			
	2%	5%	10%	20%
\$10	\$500	\$200	\$100	\$50
\$100	\$5,000	\$2,000	\$1,000	\$500
\$1,000	\$50,000	\$20,000	\$10,000	\$5,000
\$10,000	\$500,000	\$200,000	\$100,000	\$50,000
\$100,000	\$5,000,000	\$2,000,000	\$1,000,000	\$500,000

Case Study

The manager of a small restaurant in St. Louis installed new lights and roof insulation. The total project cost \$600 and saved approximately the same amount in a year. The business' overall profit margin was five percent profit against revenue.

- Because energy cost savings went straight to the bottom line, the measures contributed \$600 to the business' pretax profit after the first year ended.
- The savings were worth the equivalent of \$12,000 in additional sales. For the manager, cost reductions of \$600 were easier to achieve than increasing sales by \$12,000.

Simple Payback: A Typical Business Ranking



Simple payback is the number of years it takes to recover the cost of the energy upgrade from the energy savings.

of the capital improvements. Lower energy use will always result in lower cost—more so if energy prices rise.

Marketing benefits. Your participation in the ENERGY STAR Small Business program communicates your commitment to environmental stewardship. This message differentiates your business from those of your competitors.

Your exact mix of indirect benefits will vary by business type and upgrades performed. For many projects, these indirect benefits will be worth several

times the money you save in energy alone.

But Is It Really Worth the Time and Money?

Once you are convinced that energy-efficiency investments make financial sense in general, you still have to evaluate individual upgrades to decide which to pursue. The two most common evaluation tools are simple payback and internal rate of return (IRR).

Simple payback. Simple payback is the number of years it takes to recover the cost of the energy upgrade from the energy savings. A simple payback under four years indicates a worthwhile project. Measures with simple payback times of less than 1.5 years are excellent opportunities and should be implemented immediately.

Example of a Simple Payback Calculation: Your utility gives you a free energy assessment and tells you that if you replace 20, 100-watt incandescent bulbs used 24 hours a day in your stairways with 30-watt compact fluorescent bulbs (30 watts each) you'll save \$980 per year. The upgrade will cost you \$400.

Your simple payback is $\$400 \div \$980 = 0.4$ years, or just under 5 months.

Many businesses use simple payback to make financial decisions. The only significant shortcoming of the simple payback concept is that it doesn't take into account the expected life of the upgrade. For example, if the compact fluorescent lamps described above lasted only as long as incandescent lamps, they would burn out in less than three months. Fortunately, compact fluorescent lamps last 8 to 10 times longer, so you might want your analysis to take that into account.

Compare Your Energy-Efficiency Investments to the Interest Rates You Can Get at a Bank This table will tell you the Internal Rate of Return (IRR) if you have already calculated the simple payback.									
Simple Payback	8 years							0%	4%
	6 years						0%	7%	11%
	5 years					0%	5%	12%	15%
	4 years				0%	8%	13%	19%	21%
	3 years			0%	13%	20%	24%	29%	31%
	2.5 years			10%	22%	29%	33%	37%	38%
	2 years		0%	23%	35%	41%	45%	48%	49%
	1.5 years		22%	45%	55%	60%	63%	65%	66%
	1 year	0%	62%	84%	93%	97%	98%	100%	100%
	0.5 years	100%	173%	192%	197%	199%	200%	200%	200%
	0 years	1 year	2 years	3 years	4 years	5 years	6 years	8 years	10 years
Lifetime of new equipment or length of your planning horizon, whichever is shorter									

Internal Rate of Return. Expressing an upgrade in terms of IRR will help you compare the financial results of an upgrade against other investments. (See the glossary for the definition of IRR.) To calculate IRR you'll want to use a computer spreadsheet program or a financial calculator; you can use the table on this page as a general reference.

You can compare the IRR you calculate with the interest rates available at banks or through other investments. A good rule of thumb is that projects with IRRs above 20 percent are excellent investments and should be implemented.

Example of IRR: Converting your warehouse heating system from natural gas unit heaters to gas-fired radiant heaters will cost \$6,000 and save \$1,500 a year, which is a simple payback of four years. You can calculate the IRR for this investment as 21 percent (using a 10-year planning horizon), which makes it a very good financial option. Compare this with bank interest rates or other investments you might make (even including other ways to improve your business

such as marketing or staff training) to decide whether to do this upgrade.

Where Can I Learn More?

Call the toll-free ENERGY STAR hotline at 1-888-STAR YES and ask for the brochures listed below:

Introducing Your Company's Newest Profit Center, EPA 430-R-97-004. This is an introduction to the concept that energy upgrades are financial investments just like other business uses of capital.

Business Analysis for Energy-Efficiency Investments, EPA 430-B-97-002. This brochure describes in more detail the business-analysis approach you can use to decide if a particular upgrade or set of upgrades makes sense to invest.

Financing Your Energy-Efficiency Upgrade, EPA 430-B-97-003. This brochure describes the many financial and accounting aspects of upgrade projects in great detail. Use this information to finance your projects with the best impact on your balance sheet, cash flow, taxes, and ultimate return.

Upgrades should generally be implemented if the IRR is above 20 percent.

Prioritizing Your Projects



Use the ENERGY STAR five-stage concept to help organize a strategy for putting potential upgrades on a timeline. Each stage of the program builds upon the accomplishments of the previous stages to maximize potential energy savings, minimize investment requirements, and improve comfort and profitability for your business.

Stage One: Lighting

Many retailers and offices spend half of their electric bills on lighting, so it makes sense to address lighting first to reduce your energy costs. Efficient lighting pays for itself quickly. Lighting upgrades such as installation of compact fluorescent lamps and light-emitting diode (LED) exit signs are relatively simple to implement and can reliably deliver the expected cost savings. Upgrade your lighting before changing your heating or cooling systems because increasing your lighting efficiency lowers your air-conditioning requirements. In the winter, heating your building with your lights is expensive because new lights operate *much* cooler than old lights. Use your heating system instead. Five years of ENERGY STAR experience show that successful lighting upgrades provide Partners with dramatic savings and positive reinforcement for pursuing further projects. Lighting upgrades often improve lighting quality, which can boost worker productivity and enhance the appearance of your merchandise. For all of these reasons, we recommend you start with lighting as your first upgrade area.

Stage Two: Building Tune-Up

Bring your building back to its original design performance by addressing operations, maintenance, and small repairs. You can do many tune-up activities yourself, such as cleaning equipment and replacing filters. Other tune-up measures, such as adjusting your furnace or repairing malfunctioning controls, will require the services of contractors. Stage Two upgrades improve occupant comfort and indoor air quality, and the upgrades are no-cost or low-cost strategies that lay the foundation for further savings in later stages.

Stage Three: Load Reduction

Load reduction strategies reduce the amount of heating, cooling, or electricity use through low-cost measures that are easy to implement. Reducing the amount of heated or cooled air that escapes from your building through cracks in windows or ducts will reduce your heating and cooling costs. Window films, shades, and awnings will reduce heat gain in the summer. Or you can take advantage of landscaping measures such as adding trees and vines to block direct sunlight.

You can take simple steps to ensure that lights and office equipment are not left on by accident. And select ENERGY STAR-labeled new equipment to guarantee the best future savings.

Each stage of the program builds upon the previous stages to maximize potential energy savings, minimize investment requirements, and improve comfort and profitability.

Stage Four: Heating and Cooling Distribution System

In this stage, you should evaluate the efficiency of the fans and pumps associated with the heating, ventilating, and air-conditioning (HVAC) systems in your building. Upgrades to your distribution system will save energy while improving occupant comfort.

Stage Five: Heating and Cooling Plant

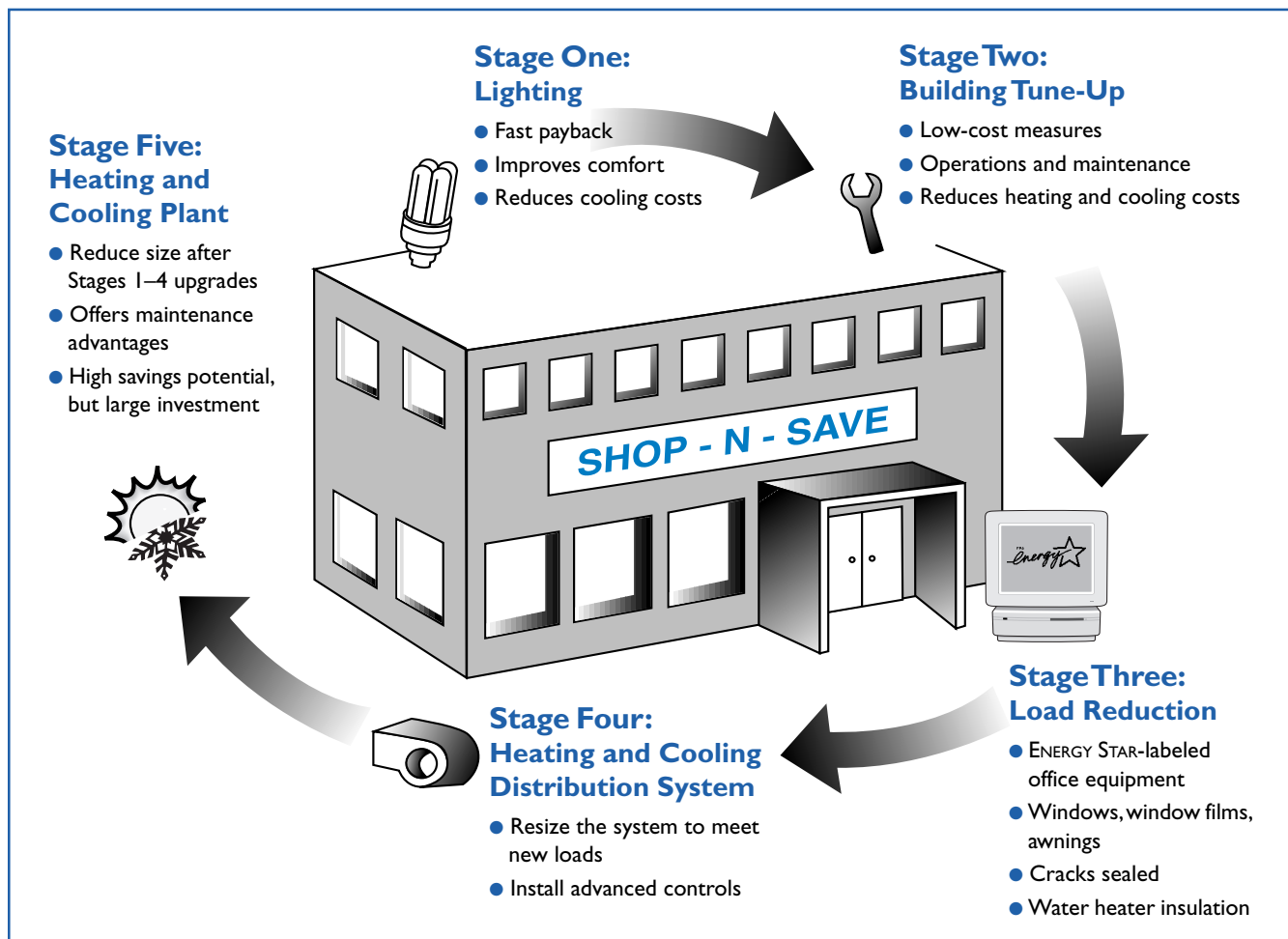
By implementing Stages One through Four, you will reduce the overall heating and cooling requirements in your facility and will now be able to afford smaller and more efficient

heating and cooling units. Because replacing heating or cooling equipment requires the largest commitment of capital, we recommend that you implement these replacements last. This is the stage when all your previous hard work and commitment will pay off.

The five-stage concept is illustrated in the chart on this page.

Where Can I Learn More?

If you would like more information on the technical aspects of the ENERGY STAR five-stage approach to building improvements, call 1-888-STAR YES and ask for the free *ENERGY STAR Buildings Manual*.



Lighting Part I: Concepts



Approximately 75 percent of all small business energy upgrades are related to lighting. Because lighting upgrades are so popular, we have included this special section on lighting concepts. If you have time to read it, you can be an informed shopper when it comes time to listen to contractor upgrade proposals or even to find your own lighting improvement opportunities. If you don't have the time, aren't interested in the background science, or just want to focus on action, go straight to the next section, **Lighting Part II: Upgrades**. We introduce specific suggestions on how to improve your lighting by upgrading your fixtures.

Whether displaying your merchandise, illuminating your factory, or providing security for your parking lot, lighting is one utility that you as a small business owner cannot do without. The amount and quality of the light can significantly affect the performance of your employees. At the same time, light also forms a significant part of your electric bill.

Fortunately, modern technology makes it possible for many businesses to improve lighting quality while reducing costs. This section first reviews how to determine the "right" amount of light for your business, discusses lighting quality issues such as color and glare, and then introduces the different types of lighting technologies in use.

Light Levels

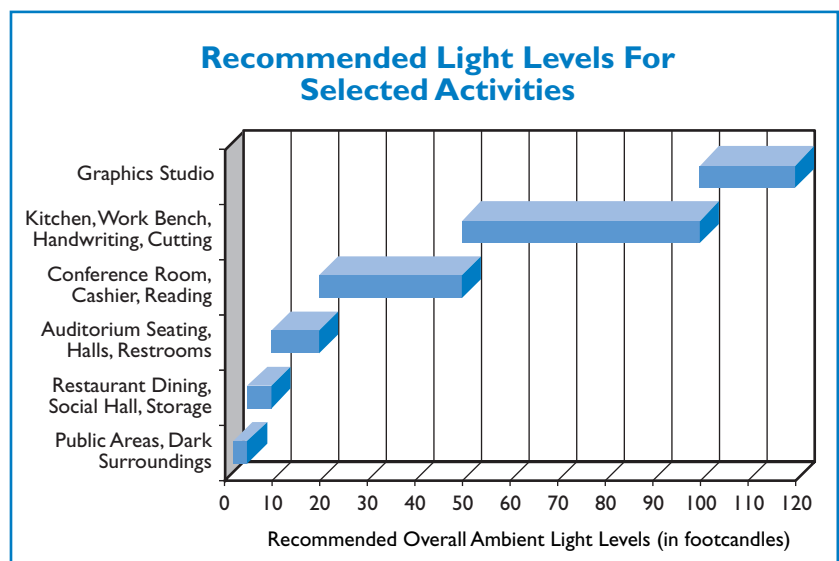
When everyone worked with pencils, paper, and typewriters, architects made sure that working environments had an abundance of light everywhere. Now that so many office environments

require the use of computers, ideal light levels and configurations are different and often lower than in the past. This means you may have the opportunity to reduce your lighting costs and improve your working environment at the same time. Since removing lamps often requires nothing more than getting on a ladder and pulling out the lamps, the cost can be negligible and you can start saving money immediately.

Although employee preferences play a large role in optimizing light levels, the Illuminating Engineering Society (IES) provides recommended light levels for different activities as shown in the graph on this page.

Compare your light levels to recommended levels. In order to compare your lighting to recommended levels, you need to know your own existing light levels. Call your lighting contractor and ask them to take the measurements for you.

Proper light levels and light quality can measurably increase sales and productivity.



Task lighting focuses extra light just where you need it and can reduce glare and eye strain.

Deep-cell parabolic fixtures are great for offices with computers because they reduce reflections in the monitors.

Alternatively, you may want to consider buying your own light meter. They cost about \$125 and are available from lighting supplier catalogs. If buying your own meter, be sure to have a lighting expert train you before you use it. Windows, reflections, and shadows will distort your readings if you're not careful.

Just try it. You don't have to bother with all those technical criteria. Remove a couple of lamps for a couple of days, and if you like the new arrangement, stick with it.

Consider task lighting. Just because you want bright light at the cash register doesn't mean you need the whole room lit up to that level. See if you can reduce light levels in some areas and focus light only where you need it. This is called "task-ambient lighting." This type of lighting design provides a blanket of lower level "ambient" light for orientation around large objects together with small fixtures shining on the "task." The current IES recommendations for computer use, for example, are 25 footcandles ambient, with a task or desk light providing 75 footcandles at the work surface.

Experiment with daylighting. Turn off lights near windows during daytime hours; you can do this manually, with a time clock or with special "daylighting" sensors made just for this purpose.

Light Quality

Isn't it frustrating to stare at your computer screen and constantly find yourself looking at the reflection of a ceiling fixture? Have you seen a fellow employee tape cardboard around the monitor? Does the light in the restroom make your face look pasty and less attractive than you know you looked at home this morning? It's not that

work is bad for your looks. All light is not the same. It turns out that these and other problems are lighting flaws that can often be overcome when you install more efficient lighting. Let's consider solutions to the problems one by one.

Solution 1: Task-ambient lighting.

Your problem may be fixture location. Moving the monitor is one solution, certainly, but a solution that more and more interior designers recommend is a combination of background ambient and task lighting. Designers generally agree that spot lighting gives a pleasant ambiance, but it can cost more to install because it requires more fixtures. Because the overall amount of light produced is lower with a mix of background and spot lighting, the arrangement uses less electricity. The extra fixture investment can pay for itself quickly in savings on your electric bills. Happier employees can be worth even more.

Solution 2: Upgrade fixtures. Many older fluorescent fixtures use a prismatic plastic lens (see the glossary in **Section 3**) to scatter light around the room. This was great before the computer age because it helped ensure that all areas were evenly lit, but lenses can create bright spots in your field of view. Now that computers are used everywhere, the preferred solution is often to use fixtures with parabolic louvers (see page 87) that direct light where you need it while lowering glare. If you're considering an upgrade in a room with computers, definitely ask your designer or contractor about switching to fixtures with louvers.

Solution 3: Improve color. All lamps distort color compared to true sunlight, but some lamps are better than others at simulating sunlight. This property of lighting is called color rendition. Lamps that render close to true color

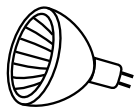
have a color-rendering index (CRI) between 85 and 100. A CRI of 50 is very poor. If you upgrade to T-8 lamps from just about any type of T-12 lamps, your color will improve and your product will look better. And better looking merchandise is better selling merchandise.

Different Kinds of Lights

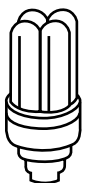
Different types of lighting are available for different applications, with a broad range of lighting efficiencies and varying degrees to which they distort color. The efficiency of lighting (more technically called efficacy) is measured by the light output per unit of energy use. Common incandescent lamps have poor efficiencies, while fluorescent lamps have much higher efficiencies. See box on this page for illustrations of the major lamp types.



Incandescent. Modern incandescent lamps derive from Thomas Edison's work before the turn of the century. They are inefficient and usually have short lives but produce a pleasant color rendering similar to that of natural sunlight.

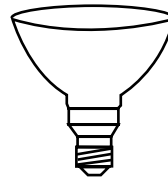


Halogen. In the past five years, halogens have surged in popularity. Halogen lamps are about twice as efficient as regular incandescent lamps and have longer lives. Halogen spotlights focus light and add a lot of pleasing "sparkle." However, they are relatively expensive to buy, and they cost more to operate than all types of lamps except incandescents.

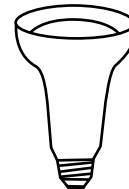


Compact fluorescent. Compact fluorescent lamps are miniature versions of standard fluorescent lamps and are usually coated to make their color more similar to that of incandescent lamps. Compact

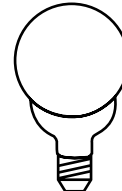
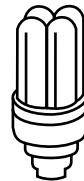
Types of Lighting Lighting Technology



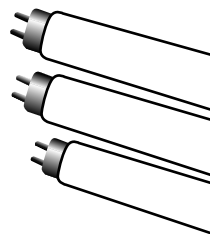
Incandescent



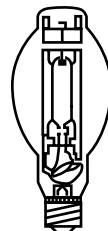
Halogen



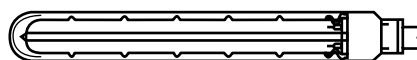
**Compact
Fluorescent**



**Tubular
Fluorescent**



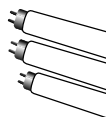
**High-Intensity
Discharge (HID)**



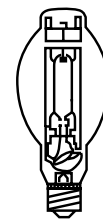
**Low-Pressure
Sodium**

Less than five percent of the electricity consumed by an incandescent lamp is actually turned into useful light.

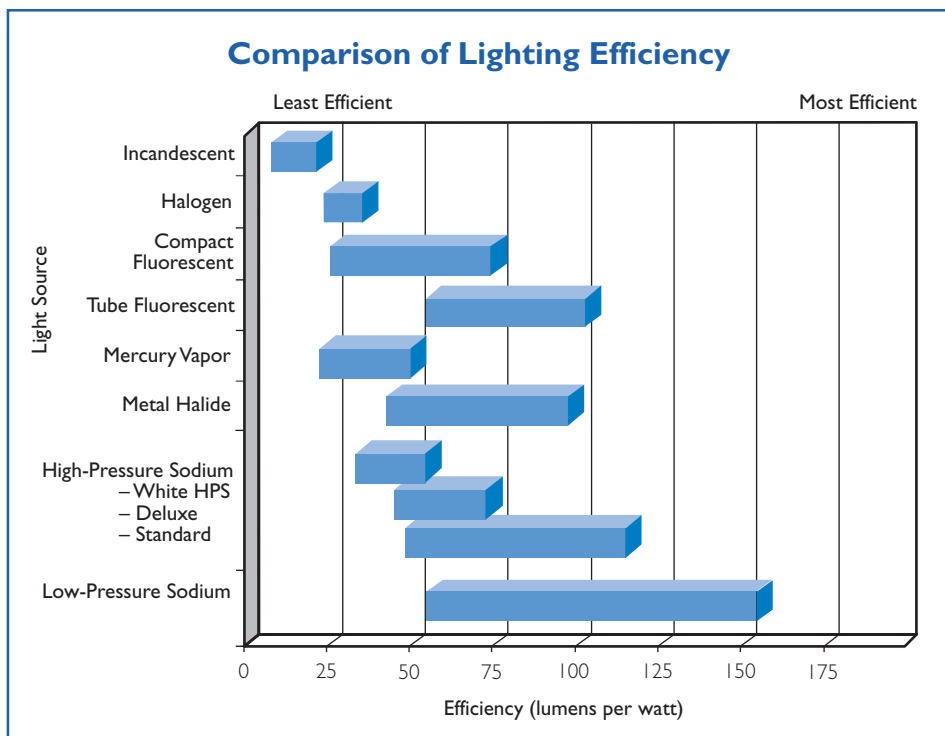
fluorescents are 4 times as efficient as incandescents and last 10 times as long in many cases, so they too are growing in popularity in the business world. They are relatively expensive to buy.



Tubular fluorescent. The ubiquitous fluorescent lamps have a wide range of efficiency but in general are about four times as efficient as incandescent lamps. They are cheap to buy, last as long as 20,000 hours, and are the staple for office lighting throughout the country.



High-intensity discharge (HID). This category of lamp includes mercury vapor, metal halide, and high-pressure sodium. HID lamps have traditionally been used mostly in warehouses and street lighting, but new research and development have created a market for lower power lamps for commercial environments. HID lamps offer good color, long life, inexpensive high ceiling and security lighting, and new retail options.



Case Study

Business Saves With the Right Light Levels

A growing software development firm in Portland, OR, signed a 10-year lease to occupy a 30-year-old, 50,000-sq.ft. office building. The business planned to renovate much of the space before moving in. Renovation plans for each 10-ft. by 12-ft. office in the building included replacing a pair of old, 4-lamp, 4-ft. fluorescent fixtures in each office with a pair of new 4-lamp fixtures that had high-efficiency lamps and electronic ballasts.

Fortunately, the business asked its design consultant to check the light levels before signing off on the remodel drawings. The consultant checked and found that the existing light levels were about 75 foot-candles (units of measure), when 50 footcandles would have been plenty. So at no cost to the tenant, the designer changed the construction specifications to 3-lamp fixtures. There were 200 offices affected by this renovation, meaning that the firm saved more than \$15,000 in 10 years by asking one simple question. That's a good deal.

Better Lighting Increases Sales and Productivity

New energy-efficient lighting can do more than just reduce your utility bills. It can also add value by:

- *Improving employee comfort and performance.* Energy-efficient lighting generates less localized heat than standard lighting, provides more pleasant color rendition, and helps prevent people from getting headaches by reducing the amount of flicker from the lights. Your employees will work better when their work environment is comfortable.
- *Improving sales.* Better color rendition means that your merchandise will look more appealing. Much like Muzak in grocery stores, improved lighting will make customers feel more comfortable, and they will choose to stay longer in your store. This leads to more sales.
- *Improving your business' image as an environmentally responsible partner in your community.* Your customers will appreciate your efforts to lower pollution and protect the Earth for future generations.

Lighting Part II: Upgrades

What's your share of \$17 billion? That's the amount EPA estimates commercial building owners and tenants could profitably save each year from lighting upgrades.

In this section we will help you identify lighting fixtures and controls in your own facility that can be replaced and add profits to your bottom line while keeping your investments a 3-year simple payback or less. Many ideas pay for themselves in less than one year. Let's get started!

If you don't have time to read the whole section, just take a quick look at the next page. It's our **Thrifty Manager's High-Speed Do-It-Yourself Lighting Assessment**. Take a look at the action list, and call your lighting or electrical contractor if you have any of the fixtures noted. It's that easy.

The rest of this section expands on the ideas in the High-Speed Lighting Assessment and explores more comprehensive upgrades as well.

Remove Incandescent Lamps



Replace these lamps with *anything* else. Of the electricity consumed by an incandescent lamp, less than five percent is actually turned into useful light. Although incandescent lamps are appropriate for certain low-use areas such as closets, in most commercial applications incandescent lamps should be replaced.

Incandescent Lamp Replacement Options

Halogen	To highlight your product. Example of application: retail
Compact Fluorescent	To keep the same screw-in fixture. Example of application: hotel hallway
Tube Fluorescent	For general lighting.
Metal Halide	For white light in high-ceiling areas. Example of application: warehouse
High-Pressure Sodium	For use outside or where color doesn't matter. Example of application: outside security
LED	For exit signs.

Note: "Energy Saver" incandescent lamps aren't much more efficient than regular incandescent lamps. They save you money just by delivering less light. Usually this is not the best solution.



Replace incandescent lamps with halogen lamps.

Halogen lamps are a type of incandescent lamp that is about twice as efficient as regular incandescent lamps. They last two to four times longer than most incandescent lamps, and they have become increasingly popular in spot lighting and other decorative applications. Halogen lamps are particularly popular in jewelry and upscale retail stores because they make gold and gems really sparkle.

The Thrifty Manager's High-Speed Do-It-Yourself Lighting Assessment

Do you have any of the following?

EXISTING LAMPS	USED AT LEAST
Incandescent lamps	6 hrs./day
Incandescent exit signs	24 hrs./day
Four or more fluorescent or incandescent fixtures on a single circuit	4 hrs./day more than needed
Incandescent or mercury vapor security lighting	10 hrs./day
Fluorescent lamps and ballasts more than eight years old	10 hrs./day

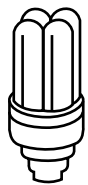
If you do, here are some of your savings opportunities.

OLD	NEW	SAVE (\$/yr/lamp)	PAYBACK IN LESS THAN
Incandescent	Compact fluorescent	\$12 energy + \$3 O&M*	2 yrs.
Incandescent exit signs	LED exit signs	\$22 energy + \$11 O&M*	3 yrs.
Four or more fluorescent or incandescent fixtures on a single circuit	Occupancy sensor	\$4 to \$16 + \$4 O&M*	3 yrs.
Incandescent or mercury vapor security lighting	Metal halide (white) or sodium (light yellow)	\$40	4 yrs.
Fluorescent lamps and ballasts more than eight years old	T-8 lamp with electronic ballasts	\$5	5 yrs.

* Operations and Maintenance

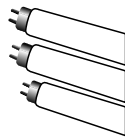
As an upgrade, the combination of better color, higher efficiency, and better cone reflectors means that many users can replace 150-watt floodlights with 35- or 60-watt halogen lamps and still get brighter, more focused light that has better color rendition. The most popular halogen lamps cost about \$7 (compared with \$1 for incandescent lamps), but they last four times as long as incandescent lamps and save about \$25 in energy costs over their lifetime. They are a good deal even before you consider labor costs and the fact that they help move merchandise. The high operating temperatures of halogen bulbs can be a fire and personal safety hazard in some applications, so ask for advice when you first buy and install the lamps.

Halogen lamp retrofits typically pay for themselves in less than three years in energy savings alone if the fixtures are used at least two hours a day for screw-in retrofits or if used at least eight hours a day for fixture replacements.



Replace incandescent lamps with compact fluorescent lamps. Compact fluorescent lamps are fluorescent lamps that have been specifically made in a compact form to replace incandescent lamps in traditional screw-in fixtures. Compact fluorescent technology has improved recently, and the lamps currently available in the marketplace are brighter and have very good color rendition properties. For example, most modern hotels have installed compact fluorescent lamps for corridor lighting. The fixture pictured on this page contains a compact fluorescent lamp and costs less than \$40. Compact fluorescent fixtures with reflectors provide an excellent substitute for floodlamps.

The table below shows the equivalency of compact fluorescent lamps to incandescent lamps. You can replace these yourself—most major hardware stores stock compact fluorescent lamps that screw right in place of incandescent lamps and cost less than \$20. Utility rebates can reduce your cost even further.



Replace incandescent lamps with tubular fluorescent lamps.

Fluorescent lamps are the common tube lamps found in almost every small business. They are usually about three to four times more efficient than incandescent lamps and can last 8 to 20 times longer. With newer fluorescent lamps, you can also specify color correction to avoid the pasty image traditionally associated with fluorescent lamps.

Tubular fluorescent lamps have much lower maintenance costs than incandescent or compact fluorescent lamps.



Would you believe this attractive fixture is made specifically for compact fluorescent lamps and costs less than \$40?

If You Have Incandescent Lamps	Replace Them With These Compact Fluorescent Lamps
25 watts	5 watts
40 watts	7 watts
60 watts	13 watts
75 watts	22 watts
100 watts	27 watts

Comparing Incandescent Lamps and Fluorescent Lamps					
Lamp Type	Energy Costs	First Cost	Life	Color	Maintenance Costs
Incandescent	Much Higher	Lower	Shorter	Good	Higher
Fluorescent	Much Lower	Higher	Longer	Better to Worse	Lower

Replace your incandescent lamps with just about any variety of fluorescent lamp and your lighting, energy, operating, and maintenance costs may decrease by about 75 percent.

EXIT Replace incandescent exit signs with light-emitting diode (LED)

exit signs. LED exit signs use light-emitting diodes that provide exit lighting and are commonly seen in electronic devices such as clock radios.

You can buy an upgrade kit to convert existing exit signs for \$25 to \$75 and do it yourself, or you can purchase

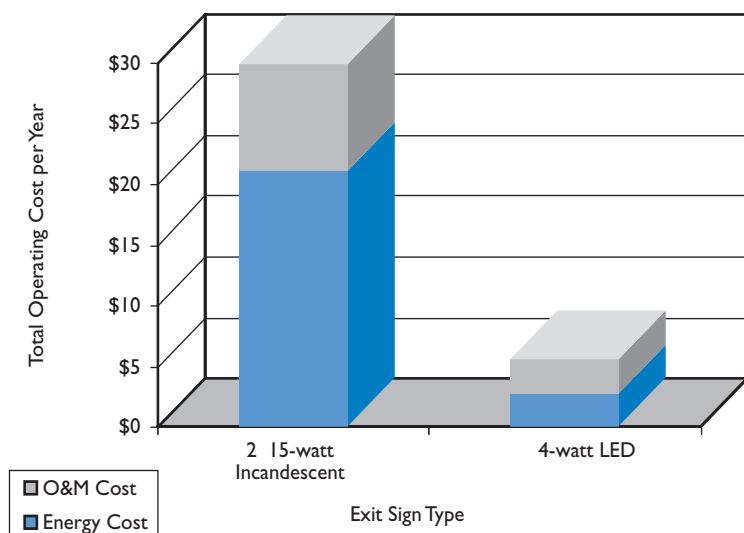
new fixtures and install them for less than \$100. Because the upgrade kits don't require any wiring, they are easier to install yourself than new signs if there is room inside the panel to install them. LED exit signs use about five percent of the energy used by incandescent exit signs and 20 percent of the energy used by compact fluorescent exit signs. LED exit signs also last 10 to 20 times longer.

The best LED exit signs on the market today are produced by manufacturers who follow EPA ENERGY STAR guidelines for energy efficiency. Look for the ENERGY STAR label when purchasing your new exit sign.

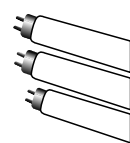
Given their installation costs, their lower maintenance costs, and low energy costs, they generally pay for themselves in one to three years. For more information on ENERGY STAR manufacturers you can visit our Web site at www.epa.gov/exitsigns.

See the bar chart on this page for annual operating costs for exit signs.

Annual Operating Cost Per Exit Sign



Upgrade Fluorescent Lamps



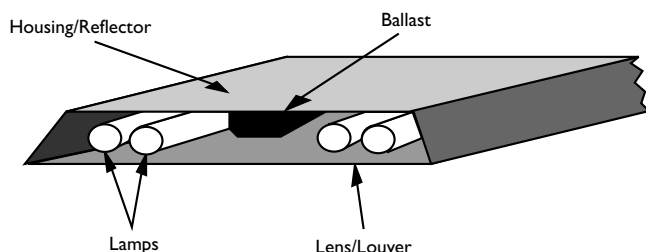
Even within the generally efficient category of fluorescent lighting, you can reduce your energy use by more than 66

percent by changing from the worst to the best type of fluorescent tubes. Fluorescent lamps were introduced at the World's Fair in New York City and San Francisco in 1939. Surprisingly, their designs changed little over the years until recent breakthroughs that have significantly improved their efficiency and the quality of the light they produce.

T-8 lamps and electronic ballasts.

T-8 lamps use their smaller diameters, phosphors, and coating to improve efficiency by about 10 percent

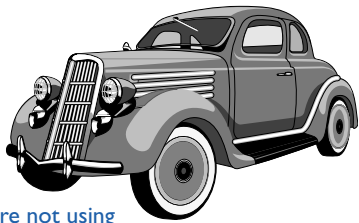
Tech Talk: Components of a Light Fixture



compared with standard T-12 lamps. Electronic ballasts use about 30 percent less energy than old magnetic ballasts. Ballasts are devices that provide the proper voltage and current to fluorescent lamps, which don't regulate themselves like incandescent lamps. T-8 conversions cost \$50 to \$100 per fixture, so you might wonder if it is worth the trouble. The answer depends on your local electricity costs and how often you use the lights. Generally if you use the lamps 60

hours per week or more the answer is "yes" or at least "yes, it's worth finding out more information." All you need to do is ask your local lighting contractor or electric utility company to perform a detailed analysis for you. This can usually be done free of charge.

Other ideas. T-8 lamps and electronic ballasts aren't your only solution. Modest gains are achieved from 34-watt "energy saver" lamps. De-lamping and/or reflectors can help also, as discussed later in this section. Some designers are switching from fluorescent tubes to lower power metal halide fixtures for a more industrial look. Consider the example scenario shown at the bottom of this page. There are four different retrofit options. None is the single "right" answer. They are all viable, cost-savings, quality-enhancing ideas. Choosing between them is a business and design decision.



If you're not using T-8 lamps and electronic ballasts in your fluorescent fixtures, you're using vintage 1940s lighting technology.

Explore Your Options

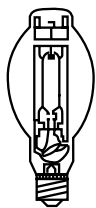
A business has 20 4-lamp, 4-ft. fluorescent fixtures in an office area. They are on about 50 hours a week. The primary tasks of most occupants require computer use. Recommended light level is between 50 and 75 footcandles.

Current Light Level	95 footcandles
Current Energy Use	9,984 kWh/year
Current Annual Energy Costs (at \$0.08/kWh)	\$799

Upgrade options	Energy savings kWh/year	Cost \$	Annual savings \$	Simple payback years	Light level	Light quality
Option 1: Install 34-watt "energy saver" lamps. Light level is lowered to about 85 footcandles.	1,664	\$360	\$133	2.7	Improved	Slightly better
Option 2: Install four T-8 lamps and an electronic ballast in each fixture. Light level remains the same.	3,744	\$1,280	\$300	4.3	Still too high	Much better
Option 3: Install two T-8 lamps in each fixture, with a specular reflector. Fixtures are "tandem-wired" so two fixtures share a single ballast. Light level becomes 55 footcandles.	6,916	\$1,340	\$553	2.4	Ideal	Much better
Option 4: Install new deep-cell parabolic fixtures with T-8 lamps and electronic ballasts. Fixtures are "tandem-wired" and light level becomes 55 footcandles.	6,916	\$2,600	\$553	4.7	Ideal	Ideal

If you replace your outside security incandescent lamps with sodium lamps, your costs may decrease by 80 to 90 percent.

Install High-Intensity Lamps



If you work in a warehouse with high ceilings and don't have fluorescent lamps, you probably use high-intensity discharge (HID) lamps. Mercury vapor lamps use older technology and are less efficient than other HID lamps, although they do provide a white light.

Upgrade from mercury vapor. At a bare minimum, you should replace mercury vapor lamps with more efficient metal halide lamps as the old lamps burn out. Even if you need to replace the ballast or the whole fixture, it turns out to be economical for almost everyone and no one can even tell you're doing it. Metal halide lamps render colors as well as mercury vapor lamps. They come in a variety of power outputs from 50 to 2,000 watts and have long life. They also come with a clear or coated bulb. The coated bulb has the best color rendition property and can be used for display lighting.

Use metal halide for retail. You've probably seen metal halide lights without even realizing it. Most of the new "big box retail" stores are illuminated using metal halides. They are the bright white lights typically hung

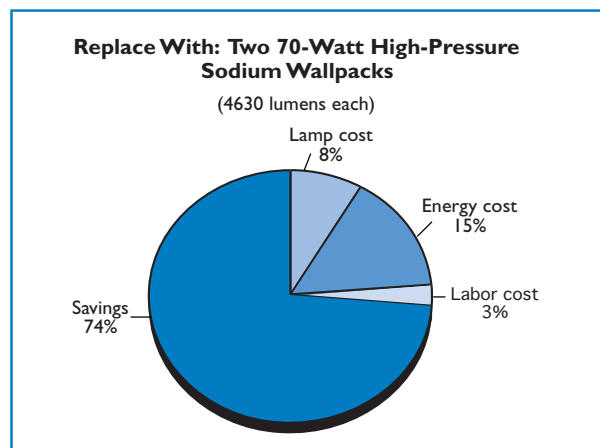
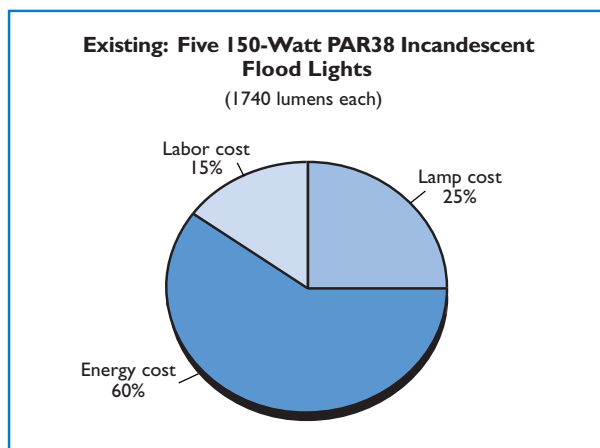
from the ceiling girders at 20 to 30 feet. If you have high bay retail, switch from fluorescent to metal halide for a brighter look without increasing your energy costs. Typical payback: five years, less if it increases sales.

Also, manufacturers have recently started selling small metal halide spotlights. The bright white light combined with the narrow beam and sparkle can make merchandise really stand out—the benefits of halogen with lower energy costs!

Use metal halide or high-pressure sodium in warehouses. Choose high-pressure sodium where light quality is not critical and rock-bottom energy use is the goal. Typical payback based on 12-hour-per-day warehouse use is about three years. Use metal halide instead in high-profile or color-sensitive areas or areas where people need to perform detailed work.



Install high-pressure sodium lamps outside. High-pressure sodium lamps are popular for warehouse, outdoor, street, and security lighting. They come in a variety of power outputs from 35 to 1,000 watts and have about a 20,000-hour life. Sodium lamps are the most efficient lamps you can buy. Most of them



have a light yellow tint, but some of the newer lamps have an attractive white color rendition and can even be used for display purposes. These new lamps tend to fade from white after a certain number of hours of use, so be sure to discuss the issue with your contractor prior to installation in customer service areas.

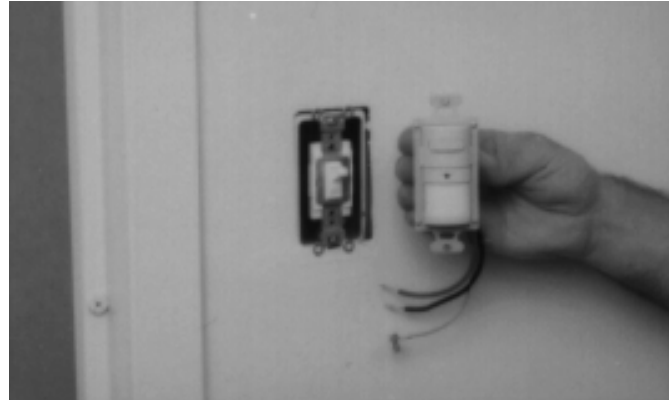
Watch out for low-pressure sodium lamps. They are efficient but *very* yellow and usually not recommended.

Replace your outside security incandescent lamps with sodium lamps and your costs may decrease by between 80 and 90 percent. The typical payback time is less than two years.

Remove Lamps

What could be a better deal than getting savings with no up-front cost? In many offices 2 lamps in a 4-lamp fluorescent fixture may be removed while still meeting recommended lighting levels. People working on computers will probably prefer the lower level because it increases the contrast on their monitors. You can experiment to see if removing lamps makes sense in your facility. Corridors are also good places to start because these areas often are overlit. Cost: \$0. Simple payback time: 0.0 years.

Lowering the number of lamps can also be an excellent measure when combined with installation of reflectors. Reflectors are not for everyone. We've found reflectors are best applied to areas that start with about 50 percent too much light and 4-lamp fluorescent fixtures. If that sounds like your site, remove half of the lamps and add reflectors to meet your target amount of light. Ask a lighting professional if they would be applicable in your facility.



Your electrician can quickly replace an existing wall switch with an occupancy sensor. You'll save money because the sensor will turn the lights off when the room is unoccupied.

Controls To Turn Lights Off

One easy way to save money and help your lights last longer is to turn them off when they are not needed. Occupancy sensors detect people in a room using ultrasonic or infrared sensors. These sensors cost between \$25 and \$80 and are an excellent choice for bathrooms or conference rooms that are likely to be unoccupied for large portions of the day. Photocells are designed to turn exterior lights on automatically when it gets dark.

Energy-Savings Potential With Occupancy Sensors

Application	Energy Savings
Offices (private)	25–50%
Offices (open spaces)	20–25%
Rest rooms	30–75%
Corridors	30–40%
Storage areas	45–65%
Meeting rooms	45–65%
Conference rooms	45–65%
Warehouses	50–75%

Note: Figures listed represent maximum energy-savings potential under optimum circumstances. Figures are based on manufacturer estimates. Actual savings may vary.

Source: CEC/DOE/EPRI

Motion sensors are suited to exterior security lighting, loading dock areas, and doorways. These sensors turn lights on automatically when a person is detected.

Automatic dimming systems that adjust lamp output based on measured sunlight are also starting to find application.

Other Lighting Technologies

Your lighting needs may be suited to other technologies involving advanced controls or alternative lighting equipment. Many fixtures can simply have some of the lamps removed with installation of reflectors. You may have exterior lighting suited to installation of low-pressure sodium fixtures, which are efficient types of lighting used when lighting quality is not important at all. You can find out about these and other technologies by calling the toll-free ENERGY STAR hotline at 1-888-STAR YES.

Take the First Step Toward Implementation

The following steps will help you decide whether you should proceed further with the lighting upgrade project.

1. Do the simple lighting assessment on page 40; or

Investigate and analyze other opportunities. Call 1-888-STAR YES for more information. Then, calculate simple payback for the project. (Refer to the box below.)

2. Call your local contractor or one of EPA's ENERGY STAR Allies if your simple payback is five years or less.

Remember, you won't save a dime until the new hardware is installed. Every day you wait, you lose money that can never be recovered.

Where Can I Learn More?

For more information on EPA's ENERGY STAR Small Business program, lighting technologies, and lighting contractors, call 1-888-STAR YES and ask for technical information on the equipment you are considering replacing.

How To Calculate Simple Payback

The Short Version

Simple Payback = Measure cost \times 1000 \div [(watts before - watts after) \times hours/year \times energy cost]

Example:

Payback = \$400 measure cost \times 1000 \div [(500w before - 100w after) \times 6000 hrs/yr use \times \$0.08/kWh] = 2.1 years

Case Study

Energy for the Kids at Sligo Adventist School

When Kenneth Gair, Plant Manager for the Sligo Adventist School, talks about his involvement with EPA's ENERGY STAR program, his face lights up. He has good reasons to smile—his facility received an ENERGY STAR's Partner of the Year award in 1995 for the work done to upgrade the lighting system in the school. Maybe his best reason to smile is that all the wasted energy that went into inefficient lighting systems now helps to power the school's new computer lab!

The lighting system at Sligo was more than 30 years old and very inefficient. Gair decided to upgrade the system by starting with the areas that would give him the quickest payback. He started with the hallways by replacing incandescent lamps with T-8 lamps and electronic ballasts. This upgrade improved light levels and certainly caught everyone's attention. People were very happy with their new working environment. He then moved on to the cafeteria and the gym. Both areas were lit with 300-watt incandescent lamps, which he replaced with metal halides. In the gym, for example, he replaced 36 300-watt incandescent lamps with 10 400-watt metal halides. Mr. Gair also upgraded outside lighting to high-pressure sodium fixtures.

Classroom lighting was upgraded to T-8 lamps, and electronic ballasts and sensors were added to each room. The hardest part about installing the sensors, Gair says, was fine-tuning the sensitivity and the delay time of the sensor. At first he got a few complaints from teachers and students because the lights would typically go off in the afternoon when teachers were alone in their rooms. Gair was able to establish the right delay time to have the classrooms lit when needed and to ensure that the lights would only be off when they were supposed to be off.

Technical information for carrying out the program came mostly from EPA's ENERGY STAR program. Gair received a video explaining the

significance of sensors and how to choose the right one for his application. He used passive infrared sensors in the classrooms and ultrasonic sensors for the restrooms.

Gair used several innovative ways to fund his upgrades. He gained the support of the school's Parent Teacher Council and used the money he received to finance his first project. Then he applied for rebates at his local utility. The money from the rebate was then funneled back to the next project, and so on. Gair was able to do most of the work himself. He managed to get extra labor at an affordable price by hiring high school students from the neighboring school.

Now that Gair has completed the lighting stage of the program (Stage One), he is looking into window replacement (Stage Three) and heating and cooling system upgrades (Stages Four and Five). Although these will be more expensive upgrades, the success of his early project will help Gair show that energy efficiency really does pay.

When we asked about his next project, he happily marched us to the schoolyard to show us an all-recycled playground!



Building Tune-Up



All cars should get tune-ups or an oil change every few thousand miles to keep them running smoothly and to help them last longer. When was the last time you gave your building and equipment a tune-up? You'll get the same kind of savings with a building tune-up as you would with an automobile tune-up—modest savings at a low cost—and an opportunity to extend the life of your investment. Every once in a while you can even get a boost in horsepower.

Check your timers and thermostats. Did you adjust them for daylight saving time? What about the last time there was a power outage? Did your weekly calendar compensate for last February 29? Does the temperature seem right? Most mechanical timers won't correct for power outages. Resetting them will improve comfort and save you some money. Ask your heating contractor to recalibrate your thermostat the next time they visit.

Check your filters. Unless the filters are inaccessible, you don't need to call your heating and cooling contractor out for an expensive visit just to make sure you have clean filters. Check the filters every month or two. Each dirty \$2 filter you replace will make your air cleaner, work your fan less, and keep the inside of the system cleaner so that it operates more efficiently. Although a new filter might only cost \$2, each dirty filter can cost you \$5 a month in extra energy consumption and can decrease the life of your system.

Check your bills. Do you know how much your electric bill is now compared to a year earlier? Once or twice a year, take time to look at and

compare your bills. Perhaps compare them with your next door neighbor's bills as well.



Replacing filters regularly is an easy way to get high air quality, low energy use, and long life for your heating and cooling equipment.

Case Study

Something To Dance About

During a periodic review, a dance studio manager in New York City noticed that his total electric bill had gradually increased to the point of doubling over the course of a year. He was now paying about \$500 per month instead of the \$250 he used to pay. His business hadn't changed and the rates looked about the same, so he called the local utility for help. The utility company sent out an energy auditor who performed a free assessment. The auditor concluded that wiring inadvertently allowed the expanding business next door to use the studio's power. That 5-minute comparison and free assessment saved the studio \$200 dollars per month!

Office Equipment



There are a lot of mysterious things about computers, but energy use isn't one of them. The computer that sits on your desk may look innocent enough, but it silently consumes \$40 per year in electricity. Although \$40 isn't enough money for you to justify throwing out your old computer and buying a new efficient one (there are plenty of other reasons for you to do this), it is enough money that you should consider energy use when you shop for a new computer.

Office equipment is the fastest growing electrical load in the business world. Unfortunately, computers, faxes, printers, and copiers waste energy when they remain on and idle. To reduce this waste of energy and the pollution associated with it, manufacturers of just about every major brand of office equipment have partnered with EPA to introduce ENERGY STAR-labeled machines that will automatically power down when not in use. The chart on this page shows the typical savings you may achieve if you buy ENERGY STAR-labeled office equipment instead of its inefficient equivalents.

It does add up. What would happen to your profits if you could cut all of your costs by 50 percent?

In addition to its direct energy consumption, office equipment gives off heat. Your air-conditioning unit must work harder to remove this unwanted heat. Introducing energy-efficient office equipment provides the added benefit of lowering utility bills due to reduced air-conditioning loads. This is Stage Three of the ENERGY STAR pro-

gram. Some of the savings will be given back in the winter.

Here's the kicker: You don't have to spend anything extra to get this savings. You also don't have to sacrifice any performance, and payback time is 0.0 years. Your choices remain virtually the same as before because so many major manufacturers have chosen to join ENERGY STAR. Just specify ENERGY STAR products or look for the logo on display models. EPA offers a number of informational fact sheets and brochures on ENERGY STAR office equipment and maintains a detailed list of qualified products that is updated monthly. For more information, call the ENERGY STAR hotline at 1-888-STAR YES or visit the Web site at www.epa.gov/smallbiz.

I Don't Want To Wait To Save

Modify user behavior so that it includes turning off computers, printers, and copiers at night, over the weekend, and even when the equipment is

Energy-efficient office equipment may lower utility bills due to reduced air-conditioning loads.

Typical Savings If You Buy ENERGY STAR-Labeled Office Equipment

Office Equipment	Annual ENERGY STAR-Labeled Office Equipment Cost Savings	Percentage of Total Operating Cost
Computer	\$19	49%
Fax Machine	\$13	52%
Printer	\$39	65%
Copier (Medium)	\$57	57%
Copier (Large)	\$130	58%

not being used for a considerable amount of time.

Consider networking your computers to share printers so that fewer printers remain idle during the day.

Your computer may already have energy saver software installed; if so, make sure that it is enabled.

How Does It Work?

The following facts on ENERGY STAR office equipment will help you to be a better shopper and decisionmaker when buying and operating new equipment.

Computers. ENERGY STAR-labeled computers automatically power down to 30 watts or less when not in use and are available from almost every manufacturer. To optimize your ENERGY STAR-labeled computer, make sure that the power management feature is enabled and that you have set it to the shortest acceptable time for your operation. Laptops use less energy than desktops.

Monitors. These are among the biggest savers. When not in use, ENERGY STAR-labeled monitors automatically power down to 30 watts or less. If you are going to implement a screen saver, make sure you select one that is compatible with the monitor's power management feature. Most screen savers available in the market actually prevent the monitor from going into sleep mode. Furthermore, turning monitors off at night and during the

What You Will Save					
	Energy Savings (kWh/yr)	Cost Savings per Year at Different Electric Rates (\$/kWh)			Percent Savings
		\$0.06	\$0.08	\$0.10	
Save Now					
Turn 24-hour equipment off at night so it runs only 9 hours per day.					
Savings per Computer	675	\$41	\$54	\$68	61%
Savings per Large Copier	6,600	\$396	\$528	\$660	56%
Save Later					
Replace older 24-hour equipment with new ENERGY STAR equipment that is used 9 hours per day.					
Savings per Computer	795	\$48	\$64	\$80	72%
Savings per Large Copier	8,910	\$535	\$713	\$891	75%



Make the Right Call. This 20-computer telemarketing center uses a lot of energy for computers and cooling. ENERGY STAR®-labeled computers would cut the center's annual electric bills by about \$500.

weekend is a practice that will provide you dual benefits. It not only reduces energy costs but in fact extends the life of the units by preserving the phosphorus substance that screen savers were designed to save. Finally, when buying a new monitor, consider the size of the unit as part of your purchasing criteria. Large monitors use more energy, so buy the smallest monitor that suits your operation.

Printers. ENERGY STAR-labeled printers that go into sleep mode when not in use save you energy and money. ENERGY STAR-labeled printers that have double-sided printing capabilities also reduce your paper costs. Networking one printer for several users is one of the best strategies you can implement to reduce energy consumption and save your business money. Not only will you benefit from reducing your energy costs, but you will also lower your capital expenditures by purchasing fewer printers.

Facsimile Machines. Because fax machines remain on 24 hours a day, they hold huge energy savings potential—up to 50 percent. ENERGY STAR-

labeled fax machines save energy in two ways. They go into sleep mode after being idle for a set period of time, and they scan double-sided pages. You will not miss any faxes if the fax machine goes into sleep mode.

Copiers. ENERGY STAR-labeled copiers are equipped with a feature that allows them to automatically turn off after a period of inactivity, which reduces their annual electricity costs by more than 60 percent. There are also several strategies that you can implement regardless of the type of copier you operate. You can purchase a correctly sized copier, use the 1- to 2-sided copy option to ensure that the duplexing feature is being used, and run copies in batches to decrease the time your copier spends in the high-powered mode.

Networking one printer for several users can reduce energy consumption and save your business money.



Paper



You may not think of your paper use as an area to save energy, but it is. Paper producers in this country buy more than \$3.5 billion of energy each year. In fact, every \$5 ream of paper you avoid using eliminates about \$0.34 worth of energy production and related emissions by a paper mill, not to mention the energy spent to harvest and ship the trees and to ship the paper to your desk. In this section, we review simple steps to optimize your use of this valuable resource. You will save money, reduce waste, and protect our nation's forests so they can be enjoyed by generations to come.

Double-Sided Copying

Copy machines often have the capability to automatically copy on both sides of a piece of paper. Selecting 2-sided copying for long documents, articles, or drafts can instantly reduce your paper use without adding any associated inconvenience. For more information, see the chart on this page.

Recycled Paper

Many paper products currently contain some recycled content. Recycling allows fibers to be reused in the production cycle so that fewer trees are required to provide the same amount of paper. Cardboard and newsprint may contain as much as 75 percent recycled content, while standard copy paper often has less than 5 percent recycled content. Selecting papers with high recycled content can be the simplest way you can help preserve our forests.

Recycled papers and other products are rated by their "post-consumer content" and "total recycled content." These percentages are usually in very small print on the paper packages. "Post-consumer content" is the more important factor and refers to fibers that have been used and are then collected through recycling programs. "Total recycled content" refers to the total nonvirgin content of the paper, including production scraps and post-consumer fibers. Paper does not have to be conspicuously labeled "environmentally friendly" to have a high recycled content, so a little research can identify some real bargains.

Paper can have a high recycled content even if it is not conspicuously labeled "environmentally friendly."

Double-Sided Copying Makes Great Business Sense Because It:

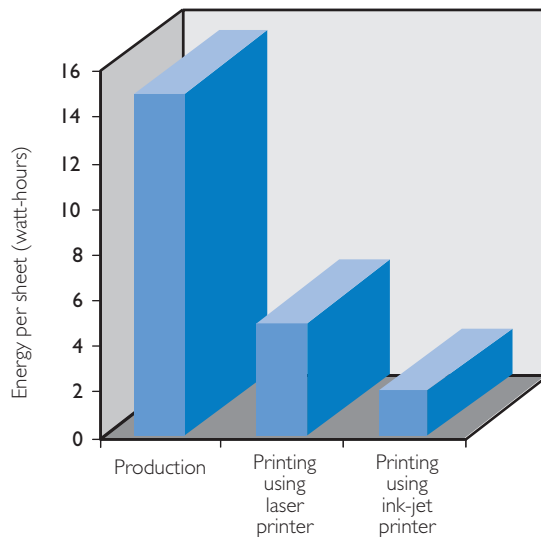
- Reduces the amount and cost of paper used.
- Lowers mailing costs because the paper amount and weight are reduced.
- Produces less paper output, which takes up less storage space in offices.
- Often has a more professional appearance.
- Reduces the environmental impacts of paper throughout the paper production process; therefore, fewer trees are harvested, there are lower chemical and energy inputs during pulping, and transportation and storage costs are reduced.
- Shows a business' commitment to environmental protection.

Andrew Duncan, *Greening of the Campus Conference Proceedings*. Ball State University, Indiana. 1996. Page 162.



Conserving paper is an important step in saving energy, lowering pollution, and ensuring the long-term health of our forests.

Energy for Paper Production and Use



Recycling

Many municipalities sponsor programs to collect paper and fiber products such as corrugated cardboard; paper-board (cereal boxes); white, colored, or glossy paper; newsprint; and books bound with glue. Collecting and returning your used paper to a recycling center will return that fiber for reuse and may reduce your waste disposal costs. If you are a large user of one or more of these products, you can set up your own collection program with a local salvage company. You will be paid by the ton for the materials that you collect, and you will save from reduced disposal costs.

Be sure to include a statement such as “Printed on 50 percent recycled paper containing 20 percent post-consumer waste” on printed materials to highlight your company’s commitment to the environment.

There are also creative ways that companies are reducing their paper use and streamlining their operations. Some items that are routinely issued as memos to all employees can simply be posted on area bulletin boards. And instead of making a copy for each person, you can circulate many documents using a routing tag containing the names of relevant personnel. An employee checks off his or her name and passes the material to the next person on the list.

Many businesses have revolutionized their operations through corporate e-mail and local area networks (LANs). In addition to greatly improving internal communication and facilitating team projects, these tools can significantly reduce paper use by replacing memos, time sheets, forms, and draft documents.

Water Heaters and Water Use



Most small businesses use hot water even if only for employee hand washing. Restaurants, hotels, and other businesses that use hot water for large purposes such as dishwashing and doing laundry can spend 25 percent or more of their total energy bill on hot water. Fortunately there are many low-cost, easy-to-apply methods for reducing your hot water costs.

Water Heaters

Turn off your water heater. Although this may seem obvious, it really is a great idea. Buy a 7-day thermostat (you can get one for about \$30) to turn off your electric water heater at night and on weekends and to turn it back on one hour before your business starts up in the morning. If you have a big water heater, you can get even more aggressive and turn it off an hour or two before quitting time. The already-heated water will be sufficient for late-day needs. You'll save anywhere from \$10 to \$50 per year with a water heater timer.

Along the same lines, consider shutting off a dedicated water heater that is rarely used and turning it on only when it is needed.

If you use a circulating pump, be sure that it is shut off when the facility is unoccupied. Again, a timer will help you remember. Circulating pumps increase heat loss through pipes that circulate hot water. A 1/8 horsepower pump that is turned off for 2,000 hours per year will save you \$25 in pump energy alone.

Lower the thermostat setting. The hotter the water temperature, the faster you lose energy through the pipes and water heater tank walls. Therefore, lower the thermostat to provide hot water at the lowest acceptable temperature. Some tasks, such as doing laundry or washing dishes, and some businesses, such as health care facilities, require higher water temperatures than others. These temperatures may be set by state and local codes. A small office with an electric water heater that is used only for hand-washing purposes would save about \$10 per year if the setting is changed from 130 degrees to 120 degrees at no cost. See the chart on page 58 for some recommended hot water temperatures.

If one task, such as laundry, requires significantly higher temperatures than other tasks, it may be more efficient to reconfigure your piping to include a blending valve. (The hottest water should be piped directly from the heater to the high-temperature task; the water for the remaining tasks should branch off and pass through a blending valve, which mixes in cold

The hotter the water temperature, the quicker you can lose energy through the pipes and water heater tank walls.

Summary

To optimize energy use of your water heater:

- Minimize hot water use.
 - Provide hot water at the lowest temperature that is acceptable for the task.
 - Insulate the tank and pipes.
 - Obtain hot water from the most efficient sources.
 - Perform periodic maintenance procedures.
-

Typical Recommended Hot Water Temperatures

Process	Temperature (degrees Fahrenheit)
Hand Washing	105
Showers	110
Laundry *	160
Dishwasher Rinse **	180–195

* Check code requirements.
** Many dishwashers have booster heaters. Check with the manufacturer to determine minimum temperature requirements.
Source: ASHRAE

Before you buy a new water heater, consult the EnergyGuide label so that you select an efficient model.

water to reduce the water temperature for the other tasks.) Alternatively, you may wish to install separate heaters for high-temperature and low-temperature tasks or to provide booster heaters for high-temperature tasks. Some machines provide their own booster-heating mechanisms.

Insulate your tank. To reduce heat losses in your hot water system, make sure that your hot water storage tank and the hot water pipes connected to it are insulated. Few hot water tanks are totally uninsulated nowadays.

Move your water heater. If you are remodeling, take the opportunity to relocate your water heater as close as possible to the main point of water consumption. This will reduce heat loss from the pipes.

Buy a new water heater. If you buy a new water heater, be sure to consult the EnergyGuide label on the appliance so that you select an efficient model. Consider using a heat pump water heater, particularly in situations where the simultaneous cooling it would provide would be useful. A relatively new and more efficient technology, heat pump water heaters remove heat from the surrounding air and transfer it to the water. Because these water heaters also cool and dehumidify the surrounding air, they are particularly beneficial in warm,

humid areas such as kitchens and laundry rooms. Another excellent alternative is tankless, instantaneous, on-demand water heaters, which are quite popular in Europe. They are growing in popularity here, too, especially in areas where relatively small amounts of hot water are used on occasion. Tankless water heaters eliminate tank losses and are great for office buildings that only have sinks. Tankless water heaters typically supply up to two gallons per minute of hot water, about the same as required for a shower and more than enough for most office sinks. One catch is that they may require heavier wiring, so check with your contractor before making a decision.

Or, don't buy a new water heater. Consider turning your standard water off except for emergencies and using "free" waste heat recovery to meet some of your water heating needs. Waste heat sources include laundry or dishwashing rinse water, steam condensate lines, and refrigeration equipment.

Maintenance

To maximize savings and keep your hot water system operating efficiently, you should perform periodic maintenance procedures. Storage-type water heater tanks should be flushed out about annually to remove sediments that reduce system efficiency. (Flushing involves opening the drain valve at the bottom of the tank and drawing off water until the water runs clear. Follow your manufacturer's instructions. In areas with high mineral content in the water, you may need to do this more often.) The burners of gas- or oil-fired water heaters should be tested and adjusted annually to make sure that the fuel is being burned as efficiently as possible. In addition, it is good practice to periodically flush your fixtures with very hot water to control bacteria growth.

Solar Water Heating

You really can't do any better than solar energy for energy savings and for the environment. Solar water heaters are simple devices that capture the sun's energy to heat water for ordinary use. They are often piped directly into systems with conventional water heaters, lowering your energy costs while still providing hot water on overcast days. Solar water heaters are extremely cost effective for heating swimming pools, where other types of heating can be very expensive.

Solar water heating is an established technology used throughout the world. In California, solar systems are the only type of pool water heating allowed by many local codes. Even the pool built for the Atlanta Olympics is heated with a solar system, though this was a unique, showcase system. While you may think of the large number of units in sunny areas like Florida or California, you may be surprised that even in the rainy areas of the Pacific Northwest, solar water heaters can pay for themselves in less than 10 years. Check with your local utility, your state energy office, and your tax preparer to find out about incentives or tax benefits that apply to solar energy systems. You can get more information, locate a solar installer, or find a supplier for a do-it-yourself system by contacting the American Solar Energy Society at (303) 443-3130 (www.ases.org).

Water Use

You may wonder why an energy manual is discussing water use. Certainly within your own facility it costs money to heat the water. But the water company also spends a lot of money on energy to pump and purify the water it delivers to you. So a portion of your water bill is actually an energy bill. The same logic holds true for sewage treatment. If you have a

business such as a restaurant, bakery, food-processing plant, hotel, nursing home, or laundry and your business uses large amounts of water, you will benefit even more from water use optimization.

Like everything else, savings from water measures can vary. You can save on the cost of the water, you can save on sewage, and you can also save on energy costs for pumping or heating processes. Because savings come from so many sources, water reduction upgrades are frequently profitable.

Efficient showerheads and faucet aerators are inexpensive devices (they generally cost between \$2 and \$20) that screw into existing pipe fittings to help reduce water consumption. These devices reduce the amount of water used in common daily tasks. If your business is a hotel, motel, or restaurant, you can use these devices to significantly reduce your water-heating bills as well as your water bills.

By repairing a seal that leaks a drop of electrically heated hot water every five seconds, you can save about 400 gallons of water, 85 kilowatt-hours (kWhs) of electricity, 125 pounds of carbon dioxide, and \$10 per year.

Solar water heaters use the sun's energy to heat water and can help you lower your energy costs.



Installing an aerator on a faucet takes just 10 minutes and costs less than \$10. Aerators save on water use and water heating costs, even though the flow from the faucet appears to be the same.

Case Study

Water Heater Tune-Up

Consider the case of an office manager of a 2,000-sq.ft. office building who discovered a leak in the pipes from a 40-gallon electric water heater. While repairing the leak, she decided to install an insulated blanket wrap around the water heater to prevent additional heat loss. The cost of the installation, the insulation, and the repair was approximately \$40. By setting the water heater thermostat to a setpoint of 120 degrees Fahrenheit, the office manager saved \$35 per year and had a 1-year payback. That extra \$35 goes to business profit year after year.

Repairing a seal that leaks a drop of electrically heated hot water every five seconds can save you about 400 gallons of water, 85 kilowatt-hours of electricity, 125 pounds of carbon dioxide, and \$10 per year.

Automatic controls such as valves or springs with sensors that turn faucets off can also help save water. The spring-loaded valves will automatically turn the water off when the user releases the handle. Photocell-equipped sensors are gaining popularity in controlling water use in restrooms. Almost all major airports have installed them due to their high intensity of use and because luggage and other articles tend to tie up travelers' hands. These sensors detect motion and shut the water off after the user leaves.

The amount of water used when flushing toilets can be drastically reduced without compromising efficacy by using new-design, low-volume toilet fittings. These fittings can reduce the amount of water used per flush by about 66 percent by using improved water flow characteristics. High-quality, pressurized, low-volume toilets tend to cost about \$200 more than gravity toilets, but they are worth the premium

if the toilets will be flushed more than 20 times per day.

New washing machines with a horizontal axis design use much less water than the older types of washing machines. The new machines can help save water as well as reduce water heating costs for laundries, hotels, and nursing homes. They can also reduce the amount of detergent that is used for washing the same amount of clothes. The newer design machines occupy less space and do not produce as much heat as the older design washing machines, which use much more hot water; thus, your rent and air-conditioning requirements can also be reduced. New machines also remove more water from the laundry during the spin cycle, thereby greatly reducing drying time and energy use.

Xeriscaping and Gray Water

Wouldn't you rather be having fun in the summer instead of taking care of the landscaping around your facility? Xeriscaping (*xer* means "dry," from Greek) is the technique of utilizing native, hardy, low-maintenance plants for landscaping. Xeriscaping can save you money on your water and maintenance costs. And because native plants cope better with your particular soil, climate, and insects, they require fewer pesticides and less fertilizer (something your 4-legged neighbors and feathered friends will appreciate). If you enter "xeriscape" into your Internet search engine, you will find dozens of Web sites offering information and programs.

We also recommend:

- Colorado Spring Utilities (Xeriscape Demonstration Garden): www.csu.org/xeri
- South West Florida Water Management District (Xeriscape): www.swfwmd.state.fl.us/conservation/xeris/swfxeris.html
- Green Building Program (Sustainable Building Sourcebook): www.greenbuilder.com/sourcebook/xeriscape.html

Water from sinks or washing machines that may contain soap but is otherwise still clean is called “gray water.” Many drought-prone areas of the country have encouraged use of this gray water for landscaping purposes. St. Petersburg, FL, has even installed a city-wide system that provides reclaimed water for 7,000 homes and businesses. Other cities do not permit reuse of gray water at all because of water quality concerns. For more information on promotional programs or restrictions on gray water use, call your local building permits office or check out the EPA Web site at www.epa.gov.

If your business is involved in any type of manufacturing or processing that uses water, you should consider reusing the waste water in some other process where your water quality requirements are not as stringent. For example, a growing microbrewery in Portland, OR, implemented an upgrade in 1992 that allows it to use its extra processing water for washdown. The plumbing was tricky, but the upgrade was ultimately very low in cost and saved a lot of natural gas.

Where Can I Learn More?

If you want more information on smart water heating, the Gas Manufacturers Association (GMA) publishes a *Consumers' Directory of Certified Efficiency Ratings* for electric, gas, and propane water heaters.

We also recommend:

- Department of Energy: www.eren.doe.gov/erec/factsheets/watheath.html
- Indoor Water Efficiency Spreadsheet (contains information on calculating energy savings): (413) 253-1520; <http://solstice.crest.org/environment/gotwh/general/indoor-water/index.html>
- Iowa Energy Center (for information about buying, installing, and upgrading hot water systems): www.energy.iastate.edu/
- Water Wiser, The Water Efficiency Clearinghouse (for information on water efficiency and conservation): 1-800-559-9855; www.waterwiser.org
- Wisconsin Energy Bureau (for general information on water heaters plus a compilation of the GMA ratings): www.doa.state.wi.us/depb/boe/index.asp

Businesses involved in any type of manufacturing or processing that uses water should consider reusing the waste water in some other processes where water quality requirements are not as stringent.

Refrigeration



Refrigeration equipment is one of the highest energy users in the competitive, low-margin supermarket, deli, and restaurant businesses. Upgrades that reduce your refrigeration costs can make your small business more competitive with other small businesses and with large businesses also.

One of the most exciting aspects of refrigeration is that there have been so many great developments over the past 25 years to make systems more efficient. The down side of all these innovations is that they can be hard to keep up with. Big chains have experts with full-time responsibility for such matters. You don't. So look for help. If your equipment is more than 10 years old, call a local refrigeration case supplier and request a checkup. You'll be surprised at all the possibilities.

A typical new residential refrigerator uses about 800 kilowatt-hours per year and costs about \$64 per year to run. This is *less than half* what you'd pay for the same size unit that is 20 years old.

No-Cost Action Items for the Refrigeration Amateur

Keep the doors shut. Repeated fluctuations in temperature will damage your food quality and will cost you money.

Check the temperature settings. If your settings are lower than necessary, chances are you are wasting energy. The most common recommended settings are between -14 degrees and -8 degrees Fahrenheit for freezers and between 35 degrees and 38 degrees Fahrenheit for refrigerators.

Properly load your refrigerator.

Overloaded units disrupt air flow patterns necessary to cool the products efficiently, and they allow deterioration to occur. On the other hand, underloaded units waste energy. If you have several partially filled units, consolidate them.

Properly position refrigeration units.

Don't put your soda display case right next to your deli bun warmer or in direct sunlight. Your refrigerator will have to work harder to maintain the desired cool temperature. Make sure that there is enough ventilation available for your refrigerator's mechanical equipment. A 1-inch gap on the sides and a 4-inch gap at the back are recommended for refrigeration units to allow the condenser and fan to have access to a steady flow of air.

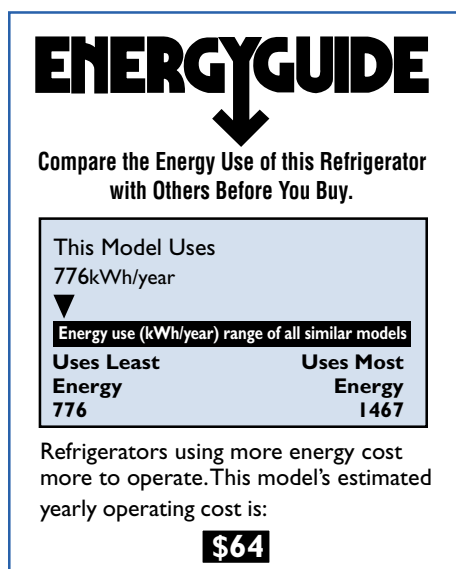
Clean the cooling coils. Dirt accumulation impairs proper heat transfer and lowers the efficiency and capacity of refrigerators.

Check the door seals. Tight seals and properly closing doors prevent warm air from entering the unit, which reduces cooling energy and prevents frost buildup. Use this rule of thumb: If you can easily slide a dollar bill into the seal, have the seal adjusted.

Performing each of the above activities can save you between \$5 and \$25 per year. These activities can also improve your product quality and extend the unit life. At no cost except a few minutes of your time, these activities are a bargain.

Shorten defrost cycles. This is starting to get a bit technical. Fifteen

A new residential-size refrigerator with the ENERGY STAR® logo is guaranteed to use 30 percent less energy than required by federal government standards.



Use the EnergyGuide label to select efficient residential-size refrigerators. (Also available for other appliances.)

Refrigeration heat recovery to water heaters or spaces is almost standard now in grocery stores with substantial hot water needs.

minutes an hour isn't perfect for everyone or for every season. If you're in a dry climate or season, gradually decrease your defrost cycle time until you see hints of frost buildup on the coils. Back the setting up a bit, and you are optimized. This procedure, like others, can help extend the unit life.

Refrigeration Capital Investments

Specify glass doors when you buy new display cases.

They bring a modern look to your store and keep cold air where you want it (with the food) and warm air on your

customers. If you can find a low-cost contractor, upgrading your open display cases by adding glass doors to them will reduce your energy costs by as much as 40 to 50 percent.

Request a humidistat instead of a timer to control the anti-sweat heaters in large display cases. This is similar to the defrost cycle idea mentioned earlier, but it involves automation.

Upgrade your "rack" system with a floating head pressure system. These pressure systems allow the compressor to work less when it is cool outside, and they consistently demonstrate savings of 20 to 30 percent.

Heat recovery to water heaters or spaces is almost standard now in grocery stores that have large systems with substantial hot water needs, such as delicatessens. In most cases, you can completely disconnect your old water heater.

Order new units with efficient lighting for new display cases. The lower wattage lights will help you reduce cooling costs by reducing the work done by the compressor to cool

the heat generated by the lamp and may improve the appearance of your products.

If you are in the market for a residential-type refrigerator, look for the ENERGY STAR® logo—your guarantee of savings. And use the EnergyGuide label to help you identify how a particular model compares with others in the market and what its annual operating costs are. You can then base your purchasing decisions on the price you can afford to pay and the highest efficiency available in that range. Calculate the simple payback for the cost premium to see how much increased efficiency you should buy.

Specify high-efficiency evaporator fans when buying new display cases.

At less than 1/10 horsepower, you wouldn't think that these little fans are a very big deal, but when considering that a grocer may use a hundred of them, it adds up. It is normally worth paying the incremental price premium when buying a new unit.

Purchase freezers and refrigerators with Energy Efficiency Ratings (EERs) ranging from seven to nine for medium-temperature systems and from five to six for low-temperature systems.

A Note About CFCs

The major challenge that the refrigeration industry has faced is the mandated phaseout of chlorofluorocarbons (CFCs). Until recently, many refrigerators used CFC-based refrigerants. The foam insulation built into older refrigerators also contains CFCs. Because CFCs deplete the ozone layer and contribute to global warming, new refrigerants have been developed to replace CFCs and are currently available in new units or as replacements for CFCs in old units. Call the EPA Stratospheric Ozone Hotline at 1-800-296-1996 for information on converting your existing refrigerators or disposal methods.

Building Construction



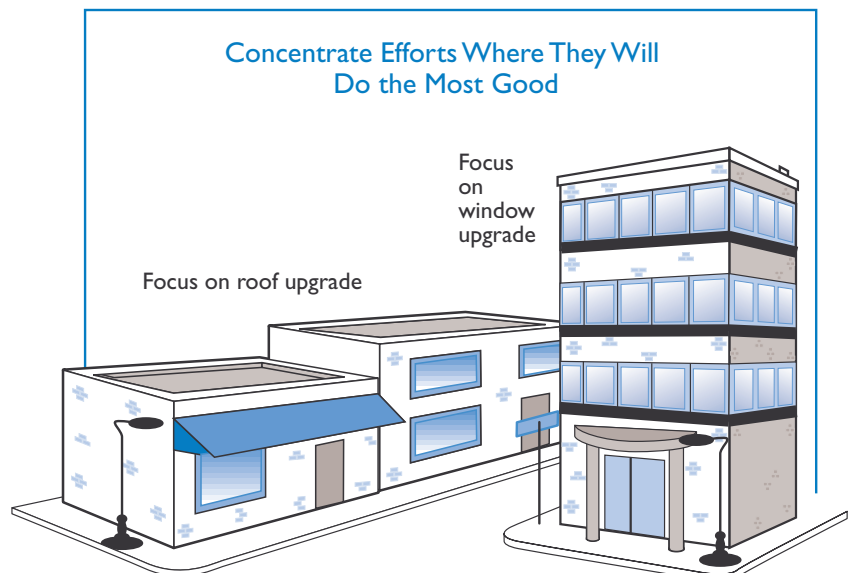
The phrase “set in stone” is frequently used to describe things that cannot be changed and must be accepted as a fact of life. This may be how you view your building’s construction and the way it affects your energy bill. Just because your building is set on a firm foundation doesn’t mean that you can’t make some changes—large or small—that can reduce the impact that your building’s exterior has on what you pay to heat and cool it. What’s more, most of the changes you make to reduce your energy costs will also bring along improvements in comfort and in your building’s appearance.

Fortunately there are many small-scale upgrades that you can make to your building’s envelope (the walls, roof, and windows) that can make the building cost less to heat and cool. Unlike the equipment inside your facility, simply changing a wall or a roof just because the original equipment isn’t efficient enough isn’t really a feasible solution. Sometimes windows of opportunity do occur to upgrade your building’s construction at relatively little extra expense. For example, roofs need to be replaced periodically, and the additional expense of adding insulation or reflective coverings at that time can be justified by the savings they will provide. Similarly, energy-saving window upgrades may be worthwhile when your building’s facade is being remodeled to modernize its appearance. In turn, when it is time to replace your heating or cooling system, you may find that by investing some money in wall or roof improvements, you can reduce your building’s heating and cooling needs enough to reduce

the size and cost of the unit equipment you need to buy. Alternatively, if your current system can’t quite heat or cool enough on extreme temperature days but is still new enough that you would rather not replace it, you can make building improvements to reduce your heating and cooling loads enough to allow your current system to meet your needs.

Most of the upgrades that you can make to your facility involve reducing heat losses in winter, reducing heat gains in summer, and reducing air leakage throughout the year. The particular envelope upgrades that make the most sense for your building depend on both the climate and the layout of your facility. A business owner in Phoenix, AZ, will be more concerned about what the summer sun is doing to his cooling bill than he would be if his business were located in Caribou, ME. Similarly, the business owner with a 1-story building will

You can reduce heat losses in winter, reduce heat gains in summer, and reduce air leakage throughout the year by upgrading your facility.





By replacing the existing windows with new 2-pane windows, this school improved indoor comfort while reducing winter heating requirements.

Case Study

Envelope Modifications Provide “Cool” Savings in Eastern North Carolina

A comfortable atmosphere in the classroom is essential to learning. An elementary school in North Carolina was faced with unbearable heat in the summer and erratic temperatures and drafts in the winter; neither condition was conducive to learning. To help ease the uncomfortable atmosphere, the administrators decided to provide air conditioning by replacing the school’s existing steam heat system with fan coil heating and cooling units that had individual room thermostats. They also replaced the single-pane windows with double-pane windows and insulated panels. The new windows, coupled with insulation added to the roof in an improvement project a few years earlier, reduced the size of the air-conditioning equipment needed, which resulted in a lower installation cost. What was the result of this air-conditioning and window replacement project? The school reduced its heating costs that winter by nearly 35 percent. And the benefits from replacing the windows were not limited to cost savings; the increased comfort levels created by eliminating drafts and the newer, more modern appearance of the school have boosted the teachers’ morale and the children’s pride in their school.

Window R-Values*

Single Pane	1.0
Double Pane	2.0
Triple Pane	2.9

Decrease R-Values by at least 20 percent if aluminum frames.

Increase R-Values by about 30 percent if low emissivity.

* See page 69 for more information on R-Values.

probably be more concerned with roof upgrades than a business owner with a 10-story building because the roof has a much larger impact on the 1-story building.

Windows

Windows are one of the most appealing parts of any building, providing its “look” and, of course, the coveted window offices. But windows are also an area where a lot of your heating and cooling costs can go literally out the window. Windows typically have low insulating levels, as anyone who has sat next to a large, single-pane window on a cold winter day can attest. In addition, windows can also allow a lot of unwanted summer heat gain, especially if they’re located on the west or south side of the building. In recent years, window manufacturers have developed low-emissivity (low-E) windows with dramatically higher insulating values and reduced heat gains, but it is unlikely that these are being used in your building if it was built before 1990.

Unless you have single-pane windows and live in a cold climate, the savings from replacing your windows with more efficient windows are hard to justify financially unless the replacement is done as part of a larger renovation. You can improve the efficiency of your existing windows, however, by installing window films.

Window films are thin coatings that can be applied to the interior surface of windows to help block radiant heat gains and losses. These coatings are similar to those used in low-E windows. Their primary benefit is in reducing summer heat gains, because they can prevent from 61 to 80 percent of the incoming solar radiation from entering your building. In winter these coatings can help reduce heat losses by preventing 19 to 44 percent of

indoor heat from escaping out the window. In addition to providing energy-cost savings, window films improve comfort by moderating heat losses and gains, reducing glare and overheating, increasing privacy by restricting visibility from the outside, improving the appearance of the windows, and reducing the fading of carpets, furniture, and merchandise. Window films typically cost between \$1.35 and \$3.00 per square foot to install, and they generally have a lifetime of 7 to 12 years. They must be installed properly to avoid bubbles, cracks, or damage to your windows.

Window accessories also affect your energy costs. White roller shades and Venetian blinds, when fully drawn, reflect heat. Draperies or curtains, when made of a tightly woven, opaque material in a light, reflective color, can reduce heat gain. If a curtain fits tightly against the window, it can also reduce winter heat losses. Awnings on the south, east, and west sides of your building can reduce summer heat gains; trees planted on the east and west sides of the building can also reduce summer heat gains. The chart below provides the simple guide to when you should use your shades, depending on the season and the time of day.

Pull Your Shades		
DAY		
SUMMER	Down	Block the sun
WINTER	Up	Let in the sun
NIGHT		
SUMMER	Up	Let building heat out
WINTER	Down	Keep building heat in

Roofs and Walls

Your building's roof can generally be improved two ways: by improving the insulation and by improving its reflectivity to reduce heat gains. Your priorities will depend upon the type of building you have and where your business is located. Roofing improvements are generally better investments for buildings that currently have a poorly insulated roof and in locations with extreme temperatures in either summer or winter.

If heating costs are a priority at your facility, or if you work in a warm climate and have an attic, roof insulation could be a good investment. If your business has attic space, insulation may be added at any time to the attic floor at a relatively low cost either by blowing in insulation or by installing batts of insulation on the attic floor. Depending upon the type of roof, insulation may be added on either the inside or the outside of the roof. If you have a flat roof, your best bet will probably be to wait until your roof needs replacement and to install rigid insulation on the roof exterior when the roof is being replaced.

How much insulation is enough? Your state or local building codes will usually require a minimum level of insulation, but keep in mind that this figure is a minimum required amount. Because codes have gradually increased the amount of insulation required, many old buildings will have less than the amount required by current codes. To get a better idea of advisable insulation levels for energy cost savings in your area, check with your state energy office or local electric utility. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) recommends an R-Value between 25 and 30 for optimum energy efficiency. See the chart on page 68 for some roofing rules of thumb.

Roof insulation could be a good investment if heating costs are a priority at your facility or if you work in a warm climate and have an attic.

Roofing Rules of Thumb

Existing Condition		Cost Effective To Add Insulation?
New Construction	→	Yes, always. R-19 to R-38 depending on location and codes.
Existing Buildings:		
Current Insulation Level		
0-1 inches	→	Yes, always.
2-4 inches	→	Yes, if attic is accessible or if built-up roof is being repaired.
5-9 inches	→	No, in moderate climates. Just add when remodeling. Yes, in extreme climates and where the attic is accessible.
More than 9 inches	→	No.

When unconditioned air from outside slips into your building, or conditioned air from inside seeps out, you have to pay to heat or cool the extra or replacement air.

If your air conditioner runs significantly more than your heating system, ask your roofing contractor about reflective roof coverings for your area. Recovering the roof with a light-colored stone, coating, or membrane is less expensive than a full roof replacement. The lighter color will cause your roof to absorb less heat and will extend the life of the roof by slowing its deterioration. Another alternative is a roof spray system, which has moisture sensors that control a spray of water over the roof to keep temperatures down. If your building has an attic space, you may be able to install a radiant barrier. A radiant barrier is essentially a layer of aluminum foil that can be tacked to the underside of your roof deck with the shiny side facing down toward the air space in your attic. It blocks 95 percent of the heat that would otherwise be radiated downward from your hot roof deck. All of these options result in lowered roof or attic temperatures, which make your upper floor a much more comfortable place during the summer. In one application in New Orleans, for example, the installation of a radiant barrier and attic vents dropped the attic temperature by 50

degrees. You can imagine the effect on comfort downstairs.

Finally, forced ventilation in attics can drop temperatures by 30 degrees or more for a big increase in comfort and savings.

Reducing Infiltration

When unconditioned air from outside slips into your building, or conditioned air seeps out, you have to pay to heat or cool that extra or replacement air. Consequently, it pays to minimize this infiltration, especially because the methods to reduce it are generally inexpensive and easily applied. Reducing infiltration will also improve your occupants' comfort because nobody is comfortable sitting next to a draft.

Use caulk to seal air-leaking cracks and to install or replace weather stripping around doors and operable windows. Small air gaps may look inconsequential, but they add up. A 1/8-inch air gap along the opening of a pair of 6-foot-8-inch doors is equivalent to a 10-square-inch hole in the wall. Replace the glass in any broken windows as soon as possible. Make sure all doors and windows close properly and—an often forgotten procedure—cover the exterior portion of any window air conditioners in the winter.

If you have a loading dock, several measures can potentially cut your costs and increase the occupants' comfort and productivity. When the loading dock door is open, make sure that any doors that separate the loading area from the rest of the facility are closed. (If there are no such doors, you may wish to install some.) If the opening is larger than needed, consider making it smaller. Have trucks back up as close as possible to the opening to reduce the amount of heated air escaping the area. If the loading dock door is

regularly left open, install a curtain of plastic strips or an air curtain to help reduce heat loss. Alternatively, consider radiant heaters, as discussed on page 75.

If You Plan To Remodel

Your options for reducing your building's energy costs are limited to some extent by the choices that were made when your building was built. Making the decision to use energy-efficient windows and appropriate insulation levels is far less expensive when a building addition is still on the drawing board. At this point the actual cost for each upgrade should be considered the incremental cost between the more and less efficient alternatives. The options that provide the best return on investment can be identified by comparing the incremental cost with the energy cost savings that will accrue over the lifetime of the building. Software packages are available and can be used to analyze these choices. If your architect is unfamiliar with these methods, you may wish to hire a consultant to help you make the optimal choices.

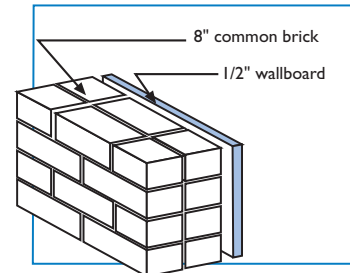
Increasing the insulating value of existing walls is difficult to justify from a cost-savings point of view. If a cold wall is a significant comfort problem, however, you may wish to do so. If you have frame walls, you can have insulation blown into the wall cavities. Otherwise, you can increase the insulating value by adding a layer of insulation over the existing interior wall and covering it with new wallboard. (You will also need to move out any light switches or electric boxes.) This solution will decrease the size of the room slightly. See the figures on this page for variations of wallboard coverings.

Consider installing a vestibule at your primary entrance, particularly if your business sees a lot of visitors. A

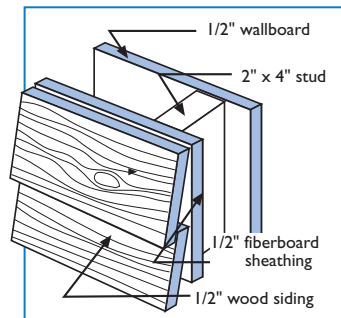
Technical Closeup: R-Values

R-Values measure the effectiveness of insulation. The higher an object's R-Value, the better it resists heat loss (or gain). Heat loss through an object is inversely proportional to its R-Value, so you get more bang for your buck from increasing the R-Value of a building component that initially has a lower R-Value than you would with a higher one. Increasing insulation from R-1 to R-20 will save you a lot more money than increasing from R-20 to R-40. For example, adding an R-Value of 1 to a window that currently has an R-Value of R-1 represents a 50-percent decrease in heat loss; adding R-1 to an R-15 wall decreases its heat loss by 6.25 percent.

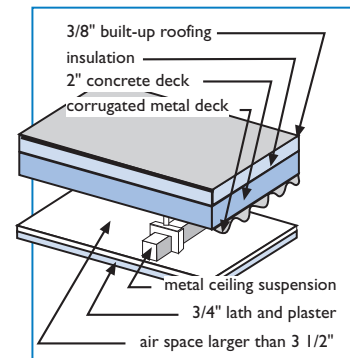
vestibule consists of a space between two sets of doors that acts as an airlock to reduce the amount of air that enters or escapes from the building as people enter or leave. You may be able to create one by installing an extra set of doors inside your building, or you may wish to build it as a small addition. This area does not need to be heated or air conditioned. In addition to reducing energy costs, this modification will dramatically increase the comfort of anyone who works near the doors. Studies show that vestibules can reduce related infiltration by more than half. Such a measure likely will not be justifiable solely on energy cost savings unless it is part of a larger upgrade, but it is justifiable when you consider the added comfortable work space it provides.



Drawing 1



Drawing 2



Drawing 3

R-Value

	Without Insulation	With Insulation
Drawing 1	R-5	R-12
Drawing 2	R-4	R-8
Drawing 3	R-5	R-9